

Clinical usefulness of microperimetry in the diagnosis of primary open-angle glaucoma

Summary

The doctoral thesis consists of a series of three publications on the usefulness of microperimetry in the management of primary open angle glaucoma (POAG). Glaucoma is a degenerative optic neuropathy leading to characteristic optic nerve head (ONH) features, thickness reduction in retinal nerve fiber layer (RNFL) and visual field (VF) defects. In previous studies was proved structural and functional abnormalities in the central part of the macula in glaucomatous eyes. Progressive loss of retinal ganglion cell (RGCs) function leads to irreversible VF defects. Standard automated perimetry (SAP) is still considered the gold standard technique for diagnosis and monitoring glaucoma. The limitations of SAP include discrepancies in the VF test due to patient fatigue, poor fixation, and eye movement during the test. Moreover, SAP can remain normal until 25% loss of RGCs.

Decrease of retinal sensitivity in the macular area is considered an important sign of glaucomatous damage. Accurate assessment of the function of the retina in macular region is possible thanks to microperimetry (MP). MP generates visual sensitivity maps with morphological correlation to retinal landmarks. Simultaneously, it is possible to evaluate the fixation behavior using the eye-tracking system independent of eye movement and to correct gaze movements. The MP test is reliable and reproducible. MP allowing for the assessment of changes in the central part of the field of view, both in qualitative and quantitative terms. Comparative studies on MP and SAP have shown that there is a good quantitative correlation between the two devices in glaucoma.

We assumed that MP is a useful method of assessing the function of the retina in the macular area and an objective method of fixation analysis. We hypothesized that macular retinal sensitivity and fixation indexes deteriorate with disease severity and correlate with structural parameters in optical coherence tomography (OCT) and OCT angiography (OCTA). The aim of our research is to establish the usefulness of MP in the routine diagnosis and monitoring of POAG.

The article *Microperimetry in the diagnosis of glaucoma* was published in "Okulistyka". The aim of this study is to review the clinical usefulness of MP in patients with POAG. The

differences between SAP and MP as well as the advantages and disadvantages of the tests were described. MP allowing for the assessment of changes in the central part of the field of view, both in qualitative and quantitative terms. Comparative studies on MP and SAP have shown that there is a good quantitative correlation between the two devices in glaucoma.

The aim of study *Correlation of retinal sensitivity in microperimetry with vascular density in optical coherence tomography angiography in primary open-angle glaucoma* published in "Plos One" was to evaluate the relationship between retinal sensitivity in MP with structural parameters using OCT and vessel density (VD) using OCTA in glaucomatous eyes.

We enrolled 30 participants (52 eyes) with POAG and 15 participants (23 eyes) in the healthy control group. All participants were examined for retinal structure using OCTA to assess VD and OCT to assess ganglion cell complex (GCC) and peripapillary RNFL (pRNFL) thickness. Retinal sensitivity was tested with MP and SAP. The VD in moderate/severe POAG was lower than that in mild POAG and healthy control in the macular superficial vascular plexus (SVP) and peripapillary radial peripapillary capillaries (pRPC). The Pearson's correlations between function and structure parameters were strongest with MP average sensitivity threshold and SVP VD in the area of whole macula. It was observed that the macular parameters (GCC thickness, SVP whole VD) showed a stronger positive correlation with the mean retinal sensitivity in MP, while the peripapillary parameters (pRNFL thickness, pRPC VD) correlated more strongly with SAP. OCTA and MP techniques are valuable methods that allow clinically monitor structural and functional changes in glaucomatous eyes.

The purpose of the publication entitled *Alterations in Fixation Indices in Primary Open-Angle Glaucoma by Microperimetry* published in "Journal of Clinical Medicine" was to determine whether POAG is associated with changes in fixation stability parameters assessed by MP and whether the severity of glaucoma is related to a deterioration in these indicators. This study analyzed fixation stability using MP macular analyzer integrity assessment (MAIA) in patients with mild and moderate/severe POAG and healthy controls. The resulting fixation indices were correlated with parameters used to assess retinal function with MP and standard automated perimetry (SAP) and retinal structure with OCT and OCTA.

We enrolled 54 eyes in the POAG groups (32 eyes with mild POAG and 22 eyes with moderate/severe POAG) and 24 eyes in the healthy group. It was shown that fixation stability in POAG eyes deteriorated with increasing disease severity, and significant differences in bivariate contour ellipse area (BCEA) including 95% of fixation points were observed among

groups. Quantitative analysis of structural and functional retinal parameters also showed significant deterioration with the progression of glaucoma.

Correlations among fixation parameters and abnormalities in the retinal structure and function were confirmed. We concluded that POAG is associated with disturbances in the fixation pattern, which worsen as the disease progresses and can be effectively assessed by performing a MP test.